PATENT SPECIFICATION 944,653

DRAWINGS ATTACHED.

944,653

Date of filing Complete Specification : Jan. 20, 1960.

Application Date : Jan. 24, 1959. No. 28833/63.
(Divided out of No. 944,651).

Complete Specification Published : Dec. 18, 1963.

Index at Acceptance :—**Class H5 H**(1J2, 1J3, 3C).

International Classification :—H 05 b.

COMPLETE SPECIFICATION.

Improvements in or relating to Water Heaters.

We, THOMAS BUTLER NELSON, of "Kinnoull", Whittingham Lane, Broughton, Preston, Lancashire, ERNEST NELSON, of 12 Harewood Road, Preston, Lancashire, HAROLD NELSON, of 29 King's Drive, Fulwood, Preston, Lancashire, and FRANK NELSON, of 26 Windermere Road, Fulwood, Preston, Lancashire, all British Subjects, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to water heaters.

According to the present invention, a water heater system comprises a closed hot or boiling water tank, a warm water tank, a water supply conduit for supplying water from said warm water tank to said hot or boiling water tank to a normal water level, heating means for heating or boiling water in said hot or boiling water tank, a vapour withdrawal conduit connected to said hot or boiling water tank above said normal water level for withdrawing from said hot or boiling water tank water vapour evolved therein, heat exchange means connected to said vapour withdrawal conduit for passing said withdrawn vapour in heat exchange with water in said warm water tank, and water withdrawal means for withdrawing hot or boiling water from said hot or boiling water tank.

Preferably the water heater system includes switch means for optionally rendering said heating means operative to boil water in said hot or boiling water tank, the conduit between said tanks including a non-return or back pressure valve supplying water to said boiling water tank, and the vapour withdrawal conduit including a control valve for withdrawing vapour from said boiling water tank, and a boiling water withdrawal conduit opening into said hot or boiling water tank at a level below the normal water level thereof, control means being provided for closing said control valve when water in said hot or boiling water tank is boiling, whereby steam generated in the hot or boiling water tank causes water to be forced through said boiling water withdrawal conduit and thereby enables boiling water to be withdrawn from said hot or boiling water tank.

Said warm water tank is conveniently supplied from a cold water tank and for this purpose is connected thereto by a conduit joining the lower portions of the warm and cold water tanks and by an air-vent joining the upper portions thereof. The cold water tank may conveniently have a ball float valve to which a mains water supply may be attached. The warm water tank may be closed, in which case the cold or the warm water tank should have a vent to the atmosphere to reduce the risk of pressure building up in the water heater system due to the water mains pressure.

A preferred embodiment of the water heater system has a first electrical heating element, which is thermostatically controlled, for heating water in the boiling water tank to a predetermined temperature below the boiling point of the water, at least one other electrical heating element, and switch means for selectively rendering said other heating element operative to boil water in said boiling water tank.

In one arrangement of the invention, a hot water withdrawal conduit conveniently communicates with said hot or boiling water

[*Price 4s. 6d.*]

tank at a point slightly above the level of said heating elements or at least not much below the top thereof and has a stopcock for the withdrawal of hot water.

In another arrangement of the invention an upstanding mixing vessel is joined to the conduit means between the warm water tank and the hot or boiling water tank with a back pressure valve between the upstanding mixing vessel and the hot or boiling water tank, a hot water withdrawal conduit communicating with the interior of said mixing vessel at a point slightly above the level of said heating elements or at least not much below the top thereof, said hot water withdrawal conduit having a stopcock for the withdrawal of hot water and said back pressure valve being operative to prevent boiling water returning only when a substantial pressure is generated in said boiling water tank. Thus hot water withdrawn through said hot water withdrawal conduit comprises a mixture of water from the warm water tank and hot or boiling water returning through the back pressure valve from the boiling water tank.

Said control means for closing said control valve preferably includes a manually operable lever and also a portion extending in the region of said switch means for opening said switch means upon closure of said control valve. In this way the power is switched off from said further heating element automatically as boiling water is withdrawn from said boiling water tank.

The invention will be further described by way of example with reference to the drawings accompanying the Provisional Specification in which:—

Fig. 1 is a schematic flow diagram of a water heater system according to one embodiment of the invention; and

Fig. 2 is a perspective view partly broken of the water heater system described with reference to Fig. 1, and with reference to the accompanying drawings which are for convenience referred to as Figs. 3 and 4 and in which:—

Fig. 3 is a schematic flow diagram similar to Fig. 1 of a water heater system according to a second embodiment of the invention; and

Fig. 4 is a perspective view partly broken of the water heater system described with reference to Fig. 3.

Referring to the drawings and more particularly to Fig. 1, a water heater system according to a particular embodiment of the invention comprising a boiling water tank 10, a warm water tank 11, and a cold water tank 12. The cold water tank can be supplied from the mains through a conduit 13 which is controlled by a float ball valve 14 and has a vent 19 to atmosphere. The lower ends of the tanks 11 and 12 are interconnected by conduit 15 for the supply of cold water to the warm water tank 11 and the upper ends of these two tanks are interconnected by an air vent 16 for allowing air to escape from the tank 11. The lower ends of the tanks 10 and 11 are interconnected by a conduit 17 which includes a non-return ball valve 18.

The boiling water tank 10 has a heating element 20 controlled by a thermostat 21 and two further heating elements 22 and 23 manually controllable by a switch 24 (shown only in Fig. 2). Hot water can be withdrawn from the boiling water tank 10 through conduit 25 which enters the tank 10 at a level slightly above the heating elements and has a stopcock 26. A conduit 30 is connected to the upper end of the boiling water tank 10, which is closed, for withdrawal of water vapour therefrom. The conduit 30 contains a control valve 31 controlled manually by means of a lever 29. (Shown only in Fig. 2.)

The warm water tank 11 contains a heat exchanger which comprises a pair of coaxial tubes 32, 33. The conduit 30 communicates with the upper end of the outer tube 32, and the inner tube 33 opens out adjacent the lower closed end of the outer tube 32. The upper end of the inner tube 33 opens into a funnel 34 which is loosely closed by a cap 35. Thus when the control valve 31 is open, the upper end of the boiling water tank 10 is in communication with the outer atmosphere through the conduit 30, the tubes 32, 33 and the funnel 34, since the cap 35 is only a loose fit.

A small syphon indicated at 36 is provided at the lower end of the outer tube 32 for withdrawing condensed vapour from the bottom end of the outer tube 32 thereby preventing condensed water from closing the lower end of the inner tube 33.

In normal operation the tanks 12 and 11 are filled to a level determined by the adjustment of the valve 14 and the tank 10 can fill up to the same level by the flow of water through the non-return valve 18. Usually the switch 24 will be off so that the heating elements 22, 23 are not operative. The heating element 20 heats the water in the boiling water tank 10 to a temperature which is controlled by the thermostat 21. This temperature will usually be for example some 20° below the boiling point of water. Hot water may be withdrawn from the tank 10 through the conduit 25 by means of the stopcock 26 as desired.

In order to obtain boiling water from the boiling water tank 10 the heating elements 22, 23 are switched on. A boiling water withdrawal conduit 40 has two downwardly extending portions 41 and 42 interconnected by a horizontal portion at their upper ends. The downwardly extending

portion 41 extends into said boiling water tank to a level below the water level of said tank and preferably slightly above the level of the heating elements 22, 23. The downwardly extending portion 42 has an air vent 43 adjacent its upper end. When it is desired to withdraw boiling water from the boiling water tank 10 the control valve 31 is closed to prevent water vapour escaping from the boiling water tank. The pressure thereby generated by steam in the boiling water tank forces water through the conduit 40. The flow of boiling water through the conduit 40 can be stopped by opening the control valve 31; the aperture 43 allows air to enter the upper end of the portion 42 of the conduit 40 to prevent water syphoning out of the tank 10.

If it is desired to withdraw steam from the boiling water tank 10 the elements 22, 23 are left on and a valve 44 in a conduit 45 leading from the lower end of the tube 32 allows steam to be withdrawn through conduit 45.

Fig. 2 is a perspective view showing a preferred arrangement of the invention. The boiling water tank 10 lies behind and adjacent to the warm water tank 11 and partially beneath and partially in front of the cold water tank 12. As will be seen from Fig. 2 the control valve 31 in the conduit 30 can be operated by means of a crank 50 which is connected to an upwardly extending portion 51 of the lever 29. The portion 51 of the lever 29 has a finger 52 attached to the lower end thereof, the finger 52 being co-operable with a switch lever 53 of the switch 24. When the switch 24 is on, the lever 53 is pressed downwards relatively to its position shown. When it is desired to withdraw boiling water from the boiling water tank 10, lever 29 is moved upwardly so that the finger 52 engages the switch lever 53 to automatically switch off the heating elements 22, 23. This obviates the risk of the elements 22, 23 being inadvertently left on after the desired amount of boiling water has been withdrawn from the boiling water tank.

The non-return valve 18 prevents boiling water returning to the warm water tank 11 under the pressure of steam generated in the boiling water tank 10 when the control valve 31 is closed. Boiling water is forced out of the boiling water tank 10 under the steam pressure until the water level falls below the level of the opening of the portion 41 of the conduit 40, steam pressure is then released, and further water can enter the boiling water tank 10 from the warm water tank 11.

The construction of the portion 42 of the conduit 40 is shown in more detail in Fig. 2. Portion 42 has an outer tube 55 which has the aperture 43 at its upper end. An inner tube 56 extends into the outer tube 55 to a point below the level of the aperture or vent 43 and is joined to a horizontal portion of the conduit 40. The inner tube 56 terminates above the water level in the tank 10. The annular space between the tubes 55 and 56 provides a passage for air communicating with the lower end of the inner tube 56.

When the elements 22, 23 are turned off the temperature of water in the boiling water tank is controlled by thermostat 21. The temperature of the water in the boiling water tank 10 will be somewhat below the boiling point but nevertheless a certain amount of water vapour will be evolved therefrom. This vapour can pass through the conduit 30, the open control valve 31 and into the outer tube 32 where it is condensed. Latent heat in this vapour is thereby substantially transferred to water in the warm water tank 11 thus preheating water before it is supplied to the boiling water tank.

The cold water tank 12 is indicated in Fig. 1 as having a vent 19 to atmosphere. However, the tank 12 may be provided with a loose lid as shown in Fig. 2. In this case a separate vent 19 is unnecessary.

As described above the boiling water tank 10 may be used to generate steam which can be withdrawn through conduit 45. This steam may, for example, be used for heating food stuffs such as canned food stuffs or for thawing frozen food stuffs.

The embodiment of a water heater system illustrated in Figs. 3 and 4 of the drawings is for the most part the same as that illustrated in Figs. 1 and 2, and those parts which are the same are given the same reference numerals.

In the embodiment of Figs. 3 and 4, however, the hot water withdrawal conduit 25 is omitted and instead an upstanding mixing vessel 90 is inserted in a conduit 117 between the warm water tank 11 and the boiling water tank 10. The conduit 117 contains a back pressure ball valve 118 between the mixing vessel 90 and the boiling water tank 10. A hot water withdrawal conduit 125 is arranged coaxially within and extends downwardly from the upstanding mixing vessel 90 and is provided with a stopcock 126. The conduit 125 opens inside the mixing vessel 90 at a level slightly above the heating elements 20, 22 and 23. The back pressure valve 118 is such that it is operative as a non-return valve to prevent return flow of boiling water only when substantial pressure has built up in the boiling water tank 10 consequent upon closure of the valve 31. Thus, when the stopcock 126 is opened to withdraw hot water from the system the water withdrawn comprises a mixture of water flowing from the warm

water tank 11 and water returning through the valve 118 from the boiling water tank 10. Thus, water withdrawn through the conduit 125 is generally not too hot to touch, whereas water withdrawn through the conduit 25 of the embodiment of Figs. 1 and 2 will nearly always be too hot to touch, as it will be at a temperature at least close to boiling point.

The mixing vessel 90 is vented by a conduit 116 to the top of the cold water tank 12 to maintain the water level in the mixing vessel 90 at the same level as the water in the tanks 11 and 12 and also at the same level as the water in the tank 10 when the valve 31 is open.

The water heater system of the invention can be conveniently heat insulated, particularly the boiling water tank. The boiling water tank is preferably spaced from the cold water tank as shown in Figs. 2 and 4 and a layer of heat insulating material may be inserted therebetween.

A water heating system constructed as shown in Fig. 2 of the drawings had three heating elements each of 750 Watts. The total capacity was 3 gallons and the boiling water tank was capable of delivering about ½ gallon of boiling water at a time.

In our co-pending Application No. 2661/59 (Serial No. 944,651) we have claimed a water heater system comprising a closed boiling water tank a conduit including a non-return or back pressure valve for supplying water thereto to fill the boiling water tank to a normal water level, heating means for heating water in said boiling water tank, thermostat control means responsive to the temperature of water in said boiling water tank for controlling said heating means to bring water in said boiling water tank to a predetermined temperature below the boiling point of water, switch means for optionally rendering said heating means operative to boil water in said boiling water tank, a vapour withdrawal conduit connected to said boiling water tank above said normal water level and, containing a control valve for withdrawing vapour from said boiling water tank, a boiling water withdrawal conduit opening into said boiling water tank at a level below the normal water level thereof, and control means for closing said control valve when water in said boiling water tank is boiling so that steam generated in said boiling water tank forces water through. said boiling water withdrawal conduit and thereby enables boiling water to be withdrawn from said boiling water tank.

In our co-pending Application No. 28832/63 (Serial No. 944,652) we have claimed a water heater system comprising a closed boiling water tank, a water supply conduit containing a non-return or back pressure valve for supplying water to said boiling water tank to a normal water level, heating means for boiling water in said boiling water tank, a vapour withdrawal conduit containing a control valve for withdrawing vapour from said boiling water tank, a boiling water withdrawal conduit comprising two portions joined at a point above the normal water level of said boiling water tank, one portion extending into said boiling water tank and opening thereinto at a level below the normal water level thereof and the other portion extending downwardly outside said boiling water tank and comprising an outer tube having an air vent and an inner tube extending downwardly into said outer tube and connected at its upper end to said one portion, said air vent being above said normal water level and said inner tube terminating within said outer tube below said air vent but above said normal water level, and control means for closing said control valve when water in said boiling water is boiling, whereby steam generated in the boiling water tank causes water to be forced through said boiling water withdrawal conduit and thereby enables boiling water to be withdrawn from said boiling water tank.

WHAT WE CLAIM IS:—

1. A water heater system comprising a closed hot or boiling water tank, a warm water tank, a water supply conduit for supplying water from said warm water tank to said hot or boiling water tank to a normal water level, heating means for heating or boiling water in said hot or boiling water tank, a vapour withdrawal conduit connected to said hot or boiling water tank above said normal water level for withdrawing from said hot or boiling water tank water vapour evolved therein, heat exchange means connected to said vapour withdrawal conduit for passing said withdrawn vapour in heat exchange with water in said warm water tank, and water withdrawal means for withdrawing hot or boiling water from said hot or boiling water tank.

2. A heater system as claimed in Claim 1 in which switch means is provided for optionally rendering said heating means operative to boil water in said hot or boiling water tank, in which said conduit from said warm water tank to said hot or boiling water tank includes a non-return or back pressure valve, and in which said water withdrawal means for withdrawing boiling water from said hot or boiling water tank comprises a control valve in said vapour withdrawal conduit, a boiling water withdrawal conduit opening into said hot or boiling water tank at a level below the normal water level thereof, and control

means for closing said control valve when water in said hot or boiling water tank is boiling so that steam generated in said hot or boiling water tank forces water through said boiling water withdrawal conduit and thereby enables boiling water to be withdrawn from said hot or boiling water tank.

3. A heater system as claimed in Claim 2 in whihc a steam withdrawal conduit containing a stop valve is connected to receive and deliver steam generated in said hot or boiling water tank.

4. A heater system as claimed in Claim 3 in which said steam withdrawal conduit is connected to said heat-exchanging means.

5. A heater system as claimed in any preceding claim having a hot water withdrawal conduit which communicates with said hot or boiling water tank at a point slightly above the level of said heating means or at least not much below the top thereof and has a stopcock for the withdrawal of hot water.

6. A heater system as claimed in any of Claims 2 to 4 in which an upstanding mixing vessel communicates with said water supply conduit between said valve therein and said warm water tank, which valve is a back pressure valve operative to prevent return flow of water from said hot or boiling water tank only when a substantial pressure has built up therein, and in which a hot water withdrawal conduit communicates with said mixing vessel at a point slightly above the level of said heating means or at least not much below the top thereof and has a stopcock for the withdrawal of hot water.

7. A heater system as claimed in Claim 6 in which said hot water withdrawal conduit is arranged concentrically within said upstanding mixing vessel and extends downwardly therefrom.

8. A heater system as claimed in any preceding claim in which a cold water tank is connected to said warm water tank by a conduit joining the lower portions of said cold and warm water tanks.

9. A heater system as claimed in Claim 8 in which said warm water tank is closed and is also connected to said cold water tank by an air vent joining the upper portions of the warm and cold water tanks.

10. A heater system as claimed in Claim 9 in which the cold water tank has a vent to the atmosphere and has a ball float valve to which a mains water supply may be attached.

11. A heater system as claimed in Claim 8, 9 or 10 when appendant to Claim 6 or 7 in which said upstanding mixing vessel is closed and is joined at its upper portion to the upper portion of the cold water tank by an air vent.

12. A heater system as claimed in any preceding claim in which said heating means comprises a thermostatically controlled first electrical heating element for heating water in the hot or boiling water tank to a predetermined temperature below the boiling point of water and at least one other electrical heating element, switch means being associated with said other electrical heating element for optionally rendering said other element operative to boiling water in said hot or boiling water tank.

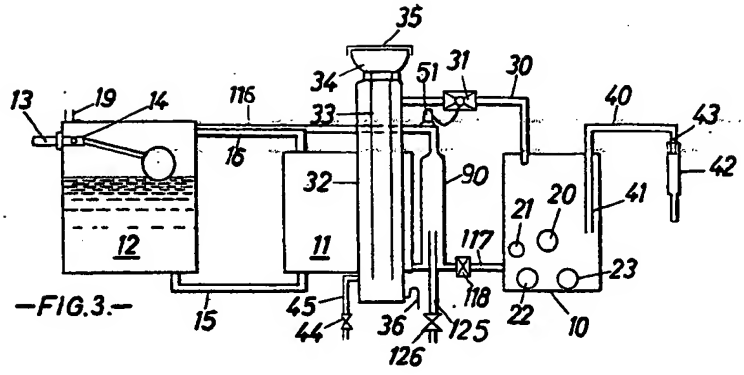
13. A heater system as claimed in Claims 2 and 12 in which said control means for closing said control valve includes a manually operable lever and also a portion extending in the region of said switch means for automatically opening said switch means to render said other heating element inoperative upon closure of said control valve.

W. P. THOMPSON & CO.,
12 Church Street,
Liverpool 1,
Chartered Patent Agents.

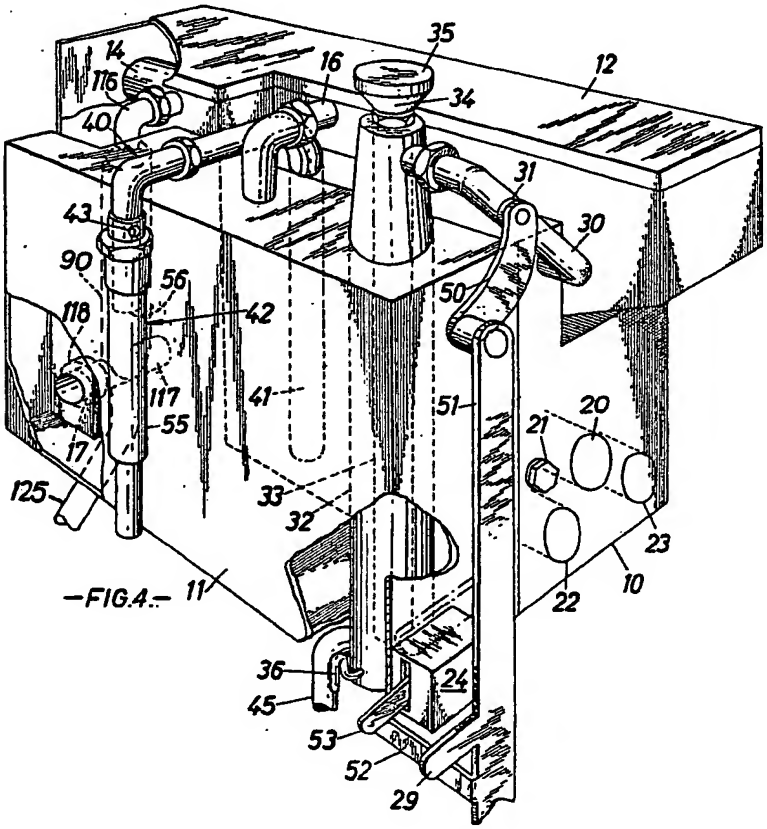
Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1963.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
from which copies may be obtained.

944653 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*



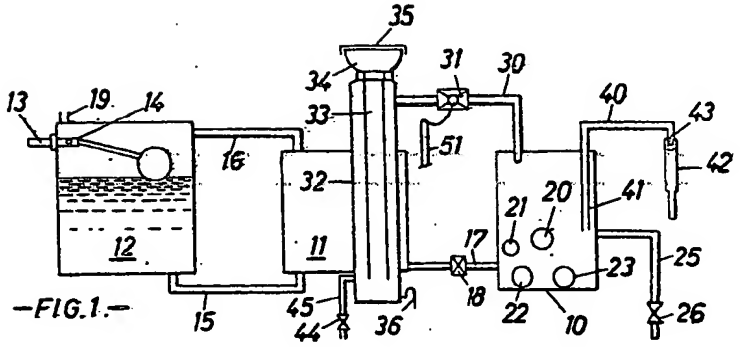
—FIG.3.—



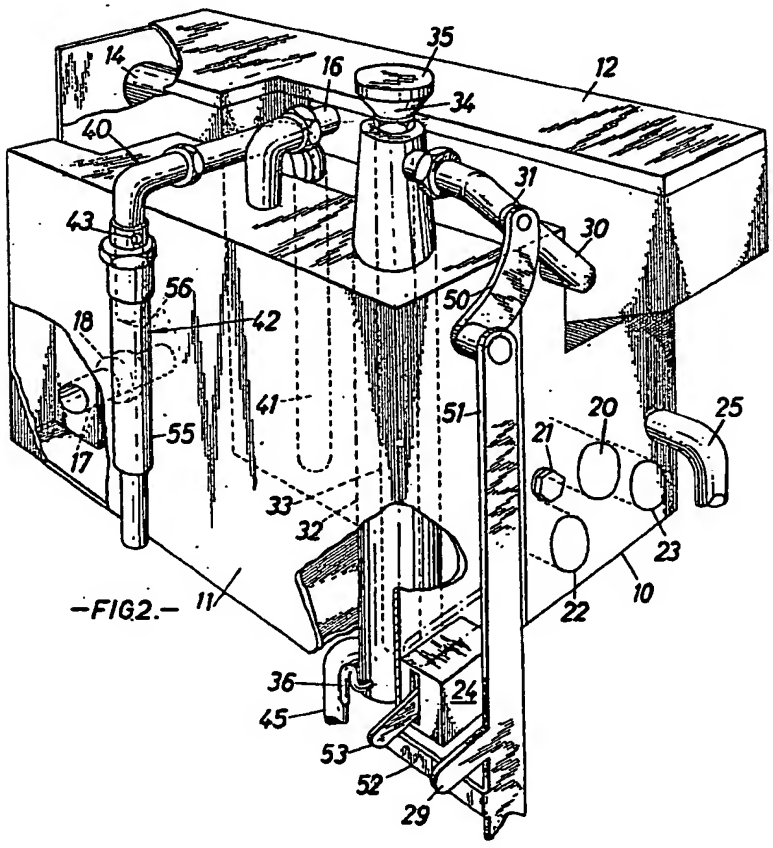
—FIG.4.—

944653 PROVISIONAL SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*



-FIG.1.-



-FIG2.-